HUMAN SPACE FLIGHT

FISCAL YEAR 2003 ESTIMATES

BUDGET SUMMARY

OFFICE OF SPACE FLIGHT **SPACE SHUTTLE**

Web Address: http://spaceflight.nasa.gov/shuttle/

	FY 2001 OP PLAN REVISED	FY 2002 INITIAL OP PLAN	FY 2003 PRES BUDGET	Page Number
		(Millions of Dollars)		
Flight Hardware	1970.6	2028.1	1844.3	HSF 2-5
Ground Operations	581.6	610.9	589.3	HSF 2-13
Flight Operations	273.0	238.0	266.6	HSF 2-18
Program Integration	293.6	395.8	507.8	HSF 2-23
(Safety Allocation - non-add)	[245.9]	[311.7]	[240.7]	
Total	3,118.8	3,272.8	3,208.0	
Distribution of Program Amount by Installation				
Johnson Space Center	1849.3	1890.2	1778.2	
Kennedy Space Center	173.7	167.3	167.3	
Marshall Space Flight Center	1034.9	977.8	887.1	
Stennis Space Center	38.8	43.8	43.4	
Dryden Flight Research Center	4.8	4.9	4.9	
Ames Research Center	2.3	0.1	--	
Langley Research Center	0.2	--	--	
Glenn Research Center	--	0.4	--	
Goddard Space Flight Center	10.9	6.9	3.0	
Headquarters	3.9	181.4	324.1	
Total	3,118.8	3,272.8	3,208.0	

Space Shuttle Linkage to Strategic Plan

The Space Shuttle program plays a vital role in NASA's strategic goal to advance human exploration, use and development of space by providing safe, routine access to space in support of both permanent commercial and human operations in low-earth orbit. The Space Shuttle program provides launch services to a diverse set of customers, supporting launch, on-orbit operations, and return to earth, of payloads that range from small hand-held experiments to large laboratories. While most missions are devoted to NASA-sponsored payloads, others including industry, partnerships, corporations, academia, national and international agencies exercise wide participation. NASA, and the U.S. and international scientific communities are beneficiaries of this approach. The Space Shuttle is a domestically and internationally sought-after research facility because of its unique ability to provide on-orbit crew operations, rendezvous/retrieval and payload provisions, including power, telemetry, pointing and active cooling.

The Space Shuttle continues to prove itself to be the most versatile launch vehicle ever built. This has been demonstrated by (1) assembling of the International Space Station (ISS); (2) advancing life sciences and technology through long-duration Spacehab missions; and (3) repairing and servicing the Hubble Space Telescope, enabling many new discoveries in Space Science. The Space Shuttle has also performed rescue and retrieval of spacecraft.

The Space Shuttle program engages the private sector in the commercial development of space by providing flight opportunities to NASA's Centers for Commercial Development of Space. These non-profit consortia of industry, academia and government were created to conduct commercially applied research activities by encouraging industry involvement leading to new products and services through access to the space environment. Cooperative activities with the National Institutes of Health (NIH), the National Science Foundation (NSF), the Department of Defense (DoD) and other U.S. agencies are advancing knowledge of health, medicine, science and technology.

In FY 2001, the Space Shuttle launched seven flights, all of which were ISS assembly and servicing missions. Seven flights are planned during FY 2002 including a dedicated microgravity research flight and another HST Servicing Mission (HST-3B) and five ISS assembly and servicing missions. In FY 2003, four flights are planned, all of which are ISS assembly and servicing missions. In support of the research objectives of the Space Station, the Space Shuttle will commit a minimum of five powered mid-deck lockers on each mission to deliver necessary research equipment and specimens.

NASA will aggressively pursue Space Shuttle competitive sourcing as an important step in transitioning NASA to purchasing space transportation services where possible. This effort was called 'privatization' in the Budget Blueprint last year, and has changed in name to 'competitive sourcing' to be consistent with the President's Management Agenda that was released last August. The challenges to complete Space Shuttle competitive sourcing are centered on ensuring that the safety is not compromised while at the same time avoiding future cost growth. An independent business review team is being established to evaluate market potential, competitive sourcing opportunities, insurance, financing, and indemnification issues associated with transitioning the Space Shuttle to private industry. Following the results of the Shuttle business review team, comprised of private industry and academia experts in the fields of investments, insurance, and finance, the Space Shuttle and will actively pursue a number of avenues to

assess industry issues and interest. NASA will seek industry comment on competitive outsourcing plans early this year. NASA will prepare, as appropriate, a cost analysis requirements document (CARD) to support NASA and independent cost estimates of Space Shuttle operations and safety investments, similar to estimates being done for the Space Station. These estimates, to be completed by September 2002, will provide an important baseline from which to assess competitive sourcing options.

The roles and missions of the contractor and government relationships have been defined to ensure program priorities are maintained and goals are achieved. The SFOC contractor is responsible for flight, ground and mission operations of the Space Shuttle. The accountability of its actions and those of its subcontractors are evaluated and incentivized through the use of a combined award/incentive fee structure of the performance-based contract. NASA, as owner of assets, customer of operations services and director of launch/flight operations, is responsible for (a) surveillance and audit to ensure compliance with SFOC requirements and (b) internal NASA functions. Further, NASA retains chairmanship of control boards and forums responsible for acceptance/rejection/waiver of Government requirements while the SFOC contractor is responsible for requirement implementation. The SFOC contractor is required to document and maintain processes/controls necessary to ensure compliance with contract requirements and to sign a certification of flight readiness (CoFR) to that effect for each flight.

The primary goals of the Space Shuttle Program in priority order are: (1) fly safely; (2) meet the flight manifest; (3) improve supportability and (4) improve the system.

NASA policy planning assumes the Space Shuttle will need to be capable of supporting the critical transportation requirements for at least this decade including the assembly of the International Space Station and International Space Station operations. In order to maintain a viable human transportation capability to support NASA's launch requirements, NASA is also making specific program investments. These investments are consistent with NASA's strategy of ensuring the Space Shuttle remains viable until a new transportation system is operational.

The overall strategy for the Shuttle budget is to request funding levels sufficient to allow the Space Flight Operations Contract to meet the intended flight rates. This includes appropriate contingency planning in both budget and schedule allowances to assure transportation and assembly support to the International Space Station program. At the same time it also incentivizes the contractor to identify opportunities for reductions in operations costs while still ensuring the safe and reliable operation of the Space Shuttle.

This budget is based on a baseline of four flights annually. In a change from previous years, Shuttle users requiring additional flights will be budgeting for those flights within their budgets. In FY 2001 seven flights were flown and seven are planned for FY 2002. FY 2002 includes five ISS flights, a Hubble Space Telescope servicing mission, and a dedicated microgravity research mission. This manifest supports the Nation's science and technology objectives through scheduled science missions and continued assembly and operations of the ISS.

In addition to flying safely, restructuring the program and conducting a single prime consolidation, we are continuing to refine the Shuttle program's strategy for the Shuttle Safety allocation. We are funding high priority safety upgrades for modifications and improvements that will provide the greatest safety improvement per dollar, to ensure continuous and affordable operations of the

Space Shuttle system for at least the next decade. This budget supports key Space Shuttle safety investments as part of NASA's Integrated Space Transportation Plan. NASA will seek to accelerate the implementation of safety investments, to begin achieving safety gains in Shuttle operations as quickly as possible. This is an essential element of the launch strategy required for continuing supportability to the ISS.

This budget also includes supportability upgrades to develop systems, which will combat obsolescence of vehicle and ground systems in order to maintain the program's safety and viability into this new century. Vendor loss, aging components, high failure rates of older components, high repair costs of Shuttle-specific devices and negative environmental impacts of some outdated technologies are areas being addressed.

This budget also supports investments in the Space Shuttle infrastructure, as necessary to address safety issues and critical repair and revitalization activities to maintain safe operations through the life of the Shuttle. This includes funding for infrastructure revitalization to meet urgent needs to revitalize and repair critical facilities, systems and equipment.

BASIS OF FY 2003 FUNDING REQUIREMENT

FLIGHT HARDWARE

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
External Tank Production	318.8	291.9	265.4
Space Shuttle Main Engine Production	263.4	250.0	215.9
Space Shuttle Main Engine Test Support	31.4	30.6	33.1
Reusable Solid Rocket Motor	377.7	382.1	374.9
Solid Rocket Booster	125.8	150.6	156.3
Vehicle and EVA	672.0	688.0	636.1
Flight Hardware Upgrades (Safety Allocation)	181.5	234.9	162.6
Total	1970.6	2028.1	1844.3

DESCRIPTION/JUSTIFICATION

The Space Shuttle program plays a vital role in NASA's strategic goal to advance human exploration, use and development of space by providing safe, routine access to space in support of both permanent commercial and human operations in low-earth orbit. The goal of Flight Hardware programs is to produce and maintain the various components of the Space Shuttle vehicles and provide for the upgrades required for safe, reliable and effective access to space.

The Flight Hardware program provides for enhancements of the Space Shuttle and produces space components that are not susceptible to damage and maintains core skills and capabilities required for modifying and maintaining the Orbiter as a safe and effective transportation and science platform. These activities are provided by Boeing Reusable Space Systems (as a major subcontractor to United Space Alliance (USA)) in two major locations: the Huntington Beach, California facility provides engineering support the Palmdale, California operation provides Orbiter Maintenance Down Period (OMDP) support as discussed below, as well as manufacturing and testing. Other activities that support this effort are subsystem management engineering and analysis conducted by Lockheed-Martin Corporation and development and modifications required for support to the extravehicular capability conducted by Hamilton Sundstrand.

The Flight Hardware program performs hundreds of modifications throughout the year related to design changes to improve reliability, supportability, or meet new program requirements. These changes are a result of hardware failures or design enhancements identified through ground checkouts or in-flight. Additional Orbiter modifications are approved as the International Space Station development advances and risk mitigation options are identified and implemented. The modifications are implemented either during a standard Orbiter processing flow at Kennedy Space Center in Florida or during Orbiter Maintenance Down Period at Palmdale, California. Orbiter Maintenance Down Periods (OMDPs) occurs when an Orbiter is taken out of service

periodically for detailed structural inspections and thorough testing of its systems before returning to operational status. This period also provides opportunities for major modifications and upgrades.

The Marshall Space Flight Center (MSFC) manages the External Tank Project Office. Lockheed Martin Corporation produces External Tanks in the Government-Owned/Contractor-Operated (GOCO) facility near New Orleans, LA. This activity involves the following:

(1) Procurement of materials and components from vendors and production of ETs;
(2) Engineering and manufacturing personnel and necessary environmental manufacturing improvements;
(3) Support personnel and other costs to operate the GOCO facility; and
(4) Sustaining engineering for flight support and anomaly resolution.

The Space Shuttle Main Engine (SSME) Project is managed by the Marshall Space Flight Center (MSFC) and supports the Orbiter fleet with flight-qualified main engine components and the necessary engineering and manufacturing capability to address any failure or anomaly quickly. The Boeing-Rocketdyne and Propulsion Power is responsible for operating three locations that provide engine manufacturing, major overhaul, and component recycle and test. They are:

(1) Canoga Park, California that manufactures and performs major overhaul to the main engines;
(2) Stennis Space Center (SSC), Mississippi for conducting engine development, acceptance and certification tests; and
(3) Kennedy Space Center (KSC), Florida where the engine inspection checkout activities are accomplished at the KSC engine shop.

The Marshall Space Flight Center (MSFC) SSME Program manages engine ground test and flight data evaluation, hardware anomaly reviews and anomaly resolution. The Alternate Turbopump project is also managed by the MSFC under contract with Pratt Whitney of West Palm Beach, FL.

The Stennis Space Center (SSC) manages the SSME Test Support. This includes development, green run, and reliability demonstration (fleet leader) testing for the Space Shuttle Main engines. All engines certified for flight are tested here prior to being shipped to KSC for pre-launch processing.

The Solid Rocket Booster (SRB) project managed out of MSFC supports:

(1) Procurement of hardware and materials needed to support the flight schedule;
(2) Work at various locations throughout the country for the repair of flown components;
(3) Workforce at the prime contractor facility for integration of both used and new components into a forward and an aft assembly; and
(4) Sustaining engineering for flight support.

USA is the prime contractor on the SRB and conducts SRB retrieval, refurbishment and processing at KSC.

The Reusable Solid Rocket Motor (RSRM) project managed out of MSFC has ATK Thiokol Propulsion of Brigham City, Utah as the prime contractor for this effort. This activity involves the following:

(1) Purchase of solid rocket propellant and other materials to manufacture motors and nozzle elements;
(2) Workforce to repair and refurbish flown rocket case segments, assemble individual case segments into casting segments and other production operations including shipment to the launch site;
(3) Engineering personnel required for flight support and anomaly resolution; and
(4) New hardware to support the flight schedule required as a result of attrition.

The Vehicle and EVA project element managed out of Johnson Space Center (JSC) consists of the following items and activities:

(1) Orbiter logistics: spares for the replenishment of Line Replacement Units (LRUs) and Shop Replacement Units (SRUs) along with the workforce required to support the program; procurement of liquid propellants and gases for launch and base support;
(2) Production of External Tank (ET) disconnects hardware;
(3) Flight crew equipment processing as well as flight crew equipment spares and maintenance, including hardware to support Space Shuttle extravehicular activity;
(4) The sustaining engineering associated with flight software and the Orbiter vehicles;
(5) Various Orbiter support hardware items such as Pyrotechnic-Initiated Controllers (PICs), NASA Standard Initiators (NSI's) and overhauls and repairs associated with the Remote Manipulator System (RMS); and

The major contractors for these Orbiter activities are United Space Alliance for operations; and Hamilton Sundstrand for extravehicular mobility unit (EMU) operations.

Other support requirements are also provided for in this budget, including tasks, which support flight software development and verification. The software activities include development, formulation and verification of the guidance, targeting and navigation systems software in the Orbiter. The Global Positioning System will replace the current TACAN navigational system in the Orbiter navigation system when the military TACAN ground stations are phased out. The GPS certification for the Space Shuttle Operation will be completed in second quarter of FY 2002.

A major area of concern for the last decade has been the Space Shuttle Main Engine Safety Improvements. Introduction of the Block I and Block II changes into the Space Shuttle's Main Engine (SSME) program has significantly improved the SSME margin of safety. The interim Block IIA configuration (Block II without the ATP High-Pressure Fuel Turbo Pump (HPFTP)) implemented the safety and performance margins provided by the Large Throat Main Combustion Chamber (LTMCC) while the HPFTP development problems were solved. The Block II engines flew successfully on STS-104.

To help ensure continued safe operations of the Space Shuttle by improving the margin of safety, the Space Shuttle program is investing in high priority safety upgrades. NASA will seek to implement all safety investments as quickly as possible, to begin realizing the benefits of those improvements.

A Safety Allocation was provided in FY 2001 to address Shuttle safety improvements through hardware/software upgrades, personnel, facility and infrastructure, or other investments. NASA conducted an external review to assess how the Safety Allocation funds can most effectively be used to improve safety of the Space Shuttle. The highest priority safety upgrades are all part of the Flight Hardware budget element, and include the following: the Cockpit Avionics Upgrade and Advanced Health Management System Phase I for the Space Shuttle Main Engines (SSME).

The Cockpit Avionics Upgrade, among the highest priority upgrades, is for improved avionics in the Shuttle cockpit. This will improve the situational awareness of the crew, and better equip them to handle potential flight anomalies. This new safety upgrade improves crew situational awareness and reduces flight crew workload. It provides automated control of complex procedures and increases the level of flight crew autonomy. Functional capabilities include enhanced Caution & Warning (a system to monitor critical instrumentation parameters), abort situation monitoring and trajectory assessment, improved integrated vehicle instrumentation displays, Remote Manipulator System (RMS) safety enhancements for the robotic arm, and rendezvous and proximity operations.

The Space Shuttle Advanced Health Management System (AHMS) is another high priority safety upgrade. This project entails a suite of instrumentation, software, and computational capabilities for real-time engine assessment, rapid turnaround, and reduction in invasive, manual processing and testing. The system includes vibration monitoring, engine performance monitoring, and overall health analysis. It consists of two phases. Phase 1 reduces pump failures, and is proceeding well.

The External Tank (ET) Friction stir weld (FSW) will provide superior welds with a highly repeatable process for the External tank production. The superior welds should provide a 20% increase in weld strength and a 95% reduction in weld repairs.

The Electric Auxiliary Power Unit (EAPU) for the Orbiter would allow the program to have battery powered electric motors replace turbines powered by hydrazine, a highly flammable and environmentally hazardous fluid. The turbines are used to drive the hydraulic pumps providing control for the orbiter such as engine movement, steering, and braking functions. The upgrade eliminates hydrazine leakage/fire hazards, eliminates turbine overspeed hazards, and reduces toxic materials processing hazards. The requirement definition and system trade studies of the EAPU have been developed. However, the EAPU has been cancelled as recommended by NASA's Space Flight Advisory Committee (SFAC) because of the lack of technical maturity.

This budget includes $148 million for safety investments as part of the safety allocation, a reduction of $125 million below what was previously planned. Reasons for this reduction include lack of performance in ongoing upgrade programs such as EAPU, and a necessary and appropriate adjustment to meet the priority of safely flying the Space Shuttle. Cost increases in many areas of Shuttle operations required additional funds. Most of the increased operations costs were offset by the reduction in planned flight rate. However, NASA determined that based on the program priorities, some funds from the safety allocation should be redirected to help pay for those increased operations costs.

Additional upgrades are being assessed by the SFAC as part of the external review, and candidates include additional upgrades to the SSME, advanced thrust vector control for the solid rocket boosters and investments in space shuttle infrastructure and others.

Prior to commitment on specific additional investments, the unspecified Safety Allocation funding is kept under Flight Hardware, although it may shift to other Space Shuttle budget elements after investment decisions are made.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable humans to live and work permanently in space.

Strategic Plan Objectives Supported: Provide and make use of safe, affordable, and improved access to space

Performance Plan Metrics Supported:
- 3H05: Assure public, flight crew, and workforce safety for all Space Shuttle operations.
- 3H06: Safely meet the FY 2003 manifest and flight rate commitment.
- 3H08: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for ISS assembly and operations.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
TACAN Removal	TBD	TBD	1st Qtr FY 2002		Project under assessment. Select flights will be flown with both systems until GPS flight hardware is certified.
Complete Discovery (OV-103) OMDP	TBD	3rd Qtr FY 2002	3rd Qtr FY 2000		Project under assessment. Conduct routine maintenance and structural inspection. Also, install the Multifunction Electronic Display System (MEDS) upgrade, hardware for GPS capability.
Cockpit Avionics Upgrades (CAU) "Authority to Proceed" for implementation Phase	4th Qtr FY 2001	3rd Qtr FY 2001	3rd Qtr FY 2001	1 Qtr later	Granted approval of "Authority To Proceed" from NASA Human Exploration and Development of Space (HEDS) Program Management Council in July 2001.
CAU Preliminary Design Review	3rd Qtr FY 2002	TBD	4th Qtr FY 2001	3 Qtrs later	Project under review.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
CAU Critical Design Review	Under Review	4th Qtr FY 2002	4th Qtr FY 2002	1 Qtr later	Project is under review.
SSME Advanced Health Management (AHM) Phase I first flight	3rd Qtr FY 2004	3rd Qtr FY 2003	3rd Qtr FY 2003	1 year later	Project in the implementation Phase
External Tank Friction Stir Weld Critical Design Review	1st Qtr FY 2002	3rd Qtr FY 2001	3rd Qtr FY 2001	2 Qtrs later	Project in the implementation phase
High Pressure Fuel Turbopump Design Certification Review	2nd Qtr FY 2001	2nd Qtr FY 2001	3rd Qtr FY 1996	--	Completed March 15, 2001 - Certified Block II engine with alternate high-pressure fuel turbopump for flight.
First flight of Block II engine	4th Qtr FY 2001	3rd Qtr FY 2001	4th Qtr FY 2000	1 Qtr later	Completed - flew on STS-104 in July 2001 which was one month later than planned.
Electric Auxiliary Power Unit (EAPU) authority to proceed for implementation phase	Cancel	Under Review	4th Qtr FY 2001	Cancel	Cancelled due to a lack of technological maturity
EAPU Preliminary Design Review	Cancel	Under Review	3rd Qtr FY 2001	Cancel	Cancelled due to a lack of technological maturity
EAPU Critical Design Review	Cancel	Under Review	2nd Qtr FY 2002	Cancel	Cancelled due to a lack of technological maturity

Lead Center: Johnson Space Center	**Other Centers:** Marshall Space Flight Center Stennis Space Center Kennedy Space Center	
Subsystem: External Tank	**Subsystem:** Space Shuttle Main Engine	**Subsystem:** Solid Rocket Booster
Major Contractors Lockheed Martin Corporation	**Major Contractors** Boeing-Rocketdyne Propulsion & Power Systems	**Major Contractors** United Space Alliance
Subsystem: Vehicle	**Subsystem:** Extravehicular Mobility Unit (EMU)	**Subsystem:** Reusable Solid Rocket Motor
Major Contractors United Space Alliance	**Major Contractors** United Space Alliance and Hamilton Sundstrand	**Major Contractors** ATK Thiokol Propulsion

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

Due to the lack of technological maturity , the Electric Auxiliary Power Unit (EAPU) has been reduced to a technology effort in FY 2002 and is not funded beyond that. The EAPU would have replaced the hydrazine-powered units by using battery-powered electric motors but due to technology development required before initiating the implementation, this project was cancelled. In addition, the Solid Rocket Booster Advance Thrust Vector Control upgrade, (which if implemented could replace the hydrazine power turbines), was also delayed due to cost growth in operations .

PROGRAM PLANS FOR FY 2003

Perform all flight and ground hardware and software processing to support four Space Shuttle missions to the International Space Station. These activities include multiple processing of Space Shuttle Orbiters, External Tanks, Solid Rocket Boosters, and Space Shuttle Main Engines. In addition, Mission Operations flight planning template, mission training and payload integration activities are planned. Line replaceable unit and material supportability activities for hardware replacement and modifications will continue to support delivery of hardware and software to ensure readiness for launch. Six external tank deliveries are planned along with the completion of the External Tank Paperless Manufacturing Effort at the Michoud facility. This paperless effort will include the interface development and system configuration, acceptance testing and user training, factory pilots, final configuration and factory implementation. The solid rocket booster forward skirts, aft skirts and solid rocket motor segments will be delivered to replenish the hardware used to support the four FY 2003 missions. The program will continue with solid rocket motor testing to certify

incorporated design changes and environmentally sensitive material changes. The Orbiter mid-deck cooling enhancement mission kits will be delivered in FY 2003 and the program will continue software updates to accommodate changes to support the STS missions. Orbiter major modifications, wiring inspections, structural inspections, and mandatory safety modifications and inspections will continue. The Space Shuttle Main Engine project will complete the Block II high-pressure fuel turbopump delivery to KSC and continue engine testing as needed.

ALTERNATE TURBOPUMP LIFE CYCLE COST

	PRIOR	FY 01	FY 02	FY 03	FY 04	BTC	TOTAL
DEVELOPMENT	751.4	14.0	6.5				771.9
PRODUCTION	173.9	22.5	21.8	2.9			221.1
TOTAL EXCLUDING CIVIL SERVICE COSTS ($M)	925.3	36.5	28.3	2.9			993.0
(ESTIMATED CIVIL SERVICE FTEs)	(539)	(21)	(7)	(5)			(572)
CIVIL SERVICE COMPENSATION ESTIMATE ($M)	34.0	1.9	1.0	0.8			39.8

ADVANCED HEALTH MONITORING PHASE 1 LIFE CYCLE COST

	PRIOR	FY 01	FY 02	FY 03	FY 04	BTC	TOTAL
DEVELOPMENT	6.0	16.0	16.0	8.0	3.0	6.0	55.0
TOTAL EXCLUDING CIVIL SERVICE COSTS ($M)	6.0	16.0	16.0	8.0	3.0	6.0	55.0
(ESTIMATED CIVIL SERVICE FTEs)	(2)	(2)	(2)	(2)	(2)		(10)
CIVIL SERVICE COMPENSATION ESTIMATE ($M)	0.3	0.3	0.3	0.3	0.3		1.5

BASIS OF FY 2003 FUNDING REQUIREMENT

GROUND OPERATIONS

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Launch and Landing Operations.....	531.5	547.6	527.9
Ground Operations Upgrades (Safety Allocation)	50.1	63.3	61.4
[Checkout and Launch Control System] [included above]	[49.0]	[61.0]	[52.1]
Total.....	581.6	610.9	589.3

DESCRIPTION/JUSTIFICATION

Ground Operations is primarily comprised of launch and landing operations, and also includes the launch site operational infrastructure, of facilities and Ground Support Equipment (GSE) at KSC and their required upgrades. The major launch site operational facilities at KSC include three Orbiter Processing Facilities (OPFs), two launch pads, the Vehicle Assembly Building (VAB), the Launch Control Center (LCC) and three Mobile Launcher Platforms (MLPs). The most significant upgrade in this account is the Checkout and Launch Control System (CLCS) at KSC.

These infrastructure upgrades support pre-launch and post-launch processing of the four-Orbiter fleet. Key enhancements funded in ground operations upgrades include: significant upgrades to the two 40-year old crawler transporters used to move a fully assembled Shuttle mounted on the MLP from the VAB to the launch pad; replacement of 16-year old ground cooling units that support all Orbiter power-on testing; replacement of communications and tracking Ku-band radar test set for the labs in the Orbiter Processing Facility and High Bays that supports rendezvous capability and the missions; sustaining the life of the existing Checkout, Control and Monitor Subsystem (CCMS) until the transition to the new Checkout and Launch Control System (CLCS) is complete; communications and instrumentation equipment modernization projects that cover the digital operational intercom system, major portions of KSC's 17-year old radio system and the operational television system; replacing failing air core copper communications cables in the Launch Complex-39 (LC-39) area; improvement of the Shuttle Operations data network that supports interconnectivity between Shuttle facilities and other KSC and off-site networks; an improved hazardous gas detection system; fiber optic cabling and equipment upgrades; and activation of various Safety & Health Construction of Facility projects in the LC-39 area.

The Crawler Transporters are approaching 40 years of service at KSC and face several end of service life and obsolescence challenges. Some of the tasks within the Crawler Transporter Upgrades project include performing comprehensive non-destructive examination of critical load path structure, installing new motor control centers, and rebuilding existing jacking cylinders and hydraulic pumps. The upgrades will continue into FY 2007.

CCMS is over 20 years old and suffers from reliability and obsolescence problems. In FY 1997, the CLCS project was initiated to replace the existing Launch Processing System (LPS). The CCMS Survivability project is intended to sustain the life of the existing CCMS through FY 2002. Due to the extended development schedule for CLCS ; CCMS must now be sustained through at least FY 2006.

The goal of the Operational Television System (OTV) Modernization project is to design and implement a state-of-the-art serial digital video surveillance facility that will meet the needs of the Space Shuttle Program today and throughout the expected life of the program. Modernization of the Operational Television System (OTV) is based upon a phased engineering design and implementation strategy, which will enhance and automate the visual surveillance capability at KSC. A key element of the plan includes the integration of video camera operations and positioning, routing switcher, video monitoring and digital recorder control system into one unified control system (UCS) environment. The implementation of the OTV modernization project will operate concurrently with the current analog system and allow for an orderly phased transition to a completely digital video system. Other key elements of the OTV modernization project include, the upgrade from analog to digital video recorders (FY 1998), the purchase and installation of a new serial digital video routing switcher (FY 2000) and the orderly phased replacement of current analog video cameras. Due to the large number of cameras in the OTV system, and the project's funding profile, the purchase and installation of new serial digital CCD cameras will be phased over a 4 to 5 year period starting FY 2002. When completed, in FY 2007, the OTV Modernization project will improve the OTV system reliability while providing the KSC Launch Team a new level of visual surveillance flexibility that promises to greatly enhance the value of the OTV system to the Shuttle program.

The Lead Cable Replacement and Refurbishment project systematically offloads the LC-39 air core copper communications cables that are failing at unacceptable rates. These cables provide basic audio and low bandwidth digital communications infrastructure for LC-39 to support many launch support systems including select Launch Processing Systems (LPS) data, Ground Support Equipment (GSE) data and control, Timing and Countdown, OTV, Range Safety data, Weather data, Paging and Area Warning, Security, and Fire alarm systems. This is a long-term project continuing beyond FY 2007.

The Complex Control System (CCS) is used to monitor and control processing and institutional facilities systems at KSC. The obsolescence of the current CCS makes it difficult and costly to incorporate new measurements and control points as new facilities are built or existing ones are upgraded. CCS infrastructure conversion is scheduled for completion in FY 2004.

Radio Frequency (RF) communications modernization replaces the existing KSC radio communications system with a combination of digital and conventional mobile, portable and fixed stations and associated off-the-shelf equipment. RF communications modernization is scheduled for completion in FY 2003.

A new Checkout and Launch Control System (CLCS) was approved for development at KSC in FY 1997. The CLCS will upgrade the Shuttle launch control room systems with state-of-the-art commercial equipment and software in a phased manner. The new system will provide a safer processing environment, enable more effective and efficient Shuttle checkout, increase future support flexibility, and mitigate future obsolescence. The CLCS development is requiring substantially more time and money to develop than initially estimated.

Ground operations support will include launch countdown and landing for seven Shuttle missions. Ground support for Shuttle landing could include both the KSC and Edwards AFB runways. Three or four orbiters are normally in the hardware processing flow along with External Tanks, Space Shuttle Main Engines and Solid Rocket Booster components to support several missions. In FY02, ground operations will support the processing, checkout and testing of Shuttle hardware to support ISS assembly and servicing missions. Ground operations for FY 2003 also include support for Space Shuttle flights.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable humans to live and work permanently in space.

Strategic Plan Objectives Supported: Provide and make use of safe, affordable, and improved access to space.

Performance Plan Metrics Supported: 3H05: Assure public, flight crew, and workforce safety for all Space Shuttle operations.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
CLCS Titan Delivery	3rd Qtr FY2001	3rd Qtr FY 2001	3rd Qtr FY 2001		The Titan delivery will provide support for completion of development and the start of validation testing for application software used for Shuttle Orbiter power testing.
CLCS Scout Delivery	3rd Qtr 2003	3rd Qtr FY 2002	3rd Qtr FY 2002	1 Year Later	The Scout phase of CLCS is planned to support operational use in the Orbiter Processing Facility and development of Pad and launch-related application software.

Lead Center:
Kennedy Space Center

Other Centers:
Johnson Space Center, Dryden Flight Research Center

Interdependencies:
Department of Defense and Foreign Countries in support of all Emergency Landing Sites.

Major Contractors
United Space Alliance

PROGRAM STATUS/NOTIFICATIONS/PLANS THROUGH 2002

CLCS software is being delivered incrementally. The Juno and Redstone phases of the CLCS were delivered in FY 1997. In these phases, the initial integration platform was defined, the engineering platform was installed and the interface with the math models was established. The Thor delivery was completed in FY 1998. During this phase, initial ground data bus interfaces were established and the system software was ported to the production platforms. The Atlas delivery in FY 1999 provided support for the initial applications for the Orbiter Processing Facility, the final applications for the Hypergolic Maintenance Facility (HMF), the math model validation, an interface to the Shuttle Avionics Integration Lab (SAIL) and hardware testing for SAIL. In addition, the Atlas Delivery provided operational capability for forward and aft propulsion system operations at the HMF. In FY 2001, the Titan baseline was delivered to support additional applications software development and validation and to enable initial OPF user acceptance. In FY 2003, the Scout phase of CLCS is planned to support operational use in the Orbiter Processing Facility (OPF) at the Vertical Assembly Building (VAB), and at the pads. The Extended Delivery will provide additional capability that enables multi-flow operational support beginning in 2004.

HMF, CITE, SAIL, and Operational Control Room #1 hardware sets have been delivered. In addition, all of the software development and test environments have been provided. Operational Control Rooms #2 and #3 will be deployed to support shuttle processing no later than 2005.

A revised estimate at completion (EAC) budget and operations-capable schedule baseline was formulated and briefed to OMB in December 2000. The current cost is estimated at $398.5M. This represents an increase of $165.2M over the estimate in the FY 2001 Budget to Congress of $233.3M. The new launch capable date is 4th quarter FY 2005 -- a delta of 39 months. The CLCS project has been executing to its new contract and structure baseline since January 1, 2001.

PROGRAM PLANS FOR FY 2003

In FY 2003, the Scout phase of CLCS is planned to support operational use in the Orbiter Processing Facility (OPF) at the Vertical Assembly Building (VAB), and at the pads. The Extended Delivery will provide additional capability that enables multi-flow operational support beginning in 2004. The CLCS will be operationally capable to support OPF processing in 2004.
The first Shuttle launch using the CLCS and project completion are scheduled for FY 2005.

CHECKOUT AND LAUNCH CONTROL SYSTEM									
	PRIOR	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**BTC**	**TOTAL**
DEVELOPMENT COSTS	157.1	55.8	61.0	52.1	37.5	26.6	8.5		398.5
TOTAL EXCLUDING CIVIL SERVICE COSTS ($M)	157.1	55.8	61.0	52.1	37.5	26.6	8.5		398.5
(ESTIMATED CIVIL SERVICE FTEs)	(378)	(118)	(121)	(110)	(78)	(39)	(7)		(851)
CIVIL SERVICE COMPENSATION ESTIMATE ($M)	34.1	10.6	11.3	10.8	8.1	4.3	0.8		80.0

BASIS OF FY 2003 FUNDING REQUIREMENT

FLIGHT OPERATIONS

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Mission Operations	206.2	171.8	190.0
Flight Crew Operations	59.4	58.5	66.3
Space and Life Sciences Operations	7.4	7.7	8.3
Flight Operations Upgrades (Safety Allocation)	--	--	2.0
Total	273.0	238.0	266.6

DESCRIPTION/JUSTIFICATION

This budget is based on a baseline of four flights annually. In a change from previous years, Shuttle users requiring additional flights will be budgeting for those flights within their budgets. FY 2001 had seven flights. FY 2002 is scheduled for a seven-flight year and includes the third Hubble Space Telescope servicing mission and STS_107, a Biological and Physical research flight. FY 2003 includes four flights, all for the International Space Station. Flights in subsequent years will focus on continuation of assembly and operations of the International Space Station.

Flight Operations include a wide variety of pre-flight planning, crew training, operations control activities, flight crew operations support, aircraft maintenance and operations and life sciences operations support. The primary contractor is United Space Alliance (USA). The planning activities range from the development of operational concepts and techniques to the creation of detailed systems operational procedures and checklists. Tasks include:

(1) Flight planning;
(2) Preparing systems and software handbooks;
(3) Defining flight rules;
(4) Creating detailed crew activity plans and procedures;
(5) Updating network system requirements for each flight;
(6) Contributing to planning for the selection and operation of Space Shuttle payloads; and
(7) Preparation and plans for International Space Station assembly.

Also included are the Mission Control Center (MCC), Integrated Training Facility (ITF), Integrated Planning System (IPS) and the Software Production Facility (SPF). Except for the SPF (Space Shuttle only), these facilities integrate the mission operations requirements for both the Space Shuttle and International Space Station. Flight planning encompasses flight design, flight analysis and software activities. Both conceptual and operational flight profiles are designed for each flight and the designers also help to

develop crew training simulations and flight techniques. In addition, the flight designers must develop unique, flight-dependent data for each mission. The data are stored in erasable memories located in the Orbiter, ITF Space Shuttle mission simulators and MCC computer systems. Mission operations funding also provides for the maintenance and operation of critical mission support facilities including the MCC, ITF, IPS and SPF. Finally, Mission and Crew Operations include maintenance and operations of aircraft needed for flight training and crew proficiency requirements.

Funds for other activities include implementing required modifications and upgrades on the T-38 aircraft used for space flight readiness training, capability improvements for weather prediction and enhancements on information handling to improve system monitoring, notably for anomaly tracking.

The major operations facilities at Johnson Space Center (JSC) include the Mission Control Center (MCC), the flight and ground support training facilities, the flight design systems and the training aircraft fleet that includes the Space Shuttle Training aircraft and the T-38 aircraft.

The Flight Operations budget also includes in FY 2001, FY 2002, and FY 2003 reimbursements from training of foreign astronauts that are assumed to be $4.4 million per year. These standard service reimbursements offset the total budget for the Space Shuttle and have been assumed in the NASA direct funding requirements identified above for the FY 2003 budget request.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable humans to live and work permanently in space.

Strategic Plan Objectives Supported: Provide and make use of safe, affordable, and improved access to space.

Performance Plan Metrics Supported:
- Assure public, flight crew, and workforce safety for all Space Shuttle operations. (3H05)
- Safely meet the FY 2003 manifest and flight rate commitment. (3H08)

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
STS-92/Discovery	October 2000	October 2000	June 2000	--	Space Station #5 (ITS-Z1) (ISS-05-3A) Mission completed.
STS-97/Endeavour	December 2000	December 2000	July 2000	--	Space Station #6 (PV Module) (ISS-06-4A). Mission completed.
STS-98/Atlantis	February 2001	February 2001	August 2000	--	Space Station #7 (US Lab (ISS-07-5A). Mission completed.
STS-102/Discovery	March 2001	March 2001	2nd Qtr FY 2000	--	Space Station #8 (MPLM-IP-01) (ISS-08-5A.1) Mission completed.
STS-100/Endeavour	April 2001	April 2001	3rd Qtr FY 2000	--	Space Station #9 (MPLM-2P-01) (ISS-09-6A) Mission completed
STS-104/Atlantis	July 2001	June 2001	4th Qtr FY 2000	1 month	Space Station #10 – Airlock (ISS-10-7A) Mission completed.
STS-105/Discovery	August 2001	July 2001	4th Qtr FY 2000	1 month	Space Station #11 (MPLM-IP-02) (ISS-11-7A.1) Mission completed.
STS-108/Endeavour	1st Qtr FY 2002	1st Qtr FY 2002	April 2001	--	Space Station #12 (MPLM) (ISS-12-UFI). Mission completed in December 2001.
STS-107/Columbia	4th Qtr FY 2002	1st Qtr FY2002	January 2001	3 Qtrs later	Research Mission (Spacehab Double Module). Mission was delayed because of orbiter modifications and necessary wiring repairs to OV-102. This pushed the mission to within one month of the STS-109 mission. A decision was made to give priority to the STS-109 mission due to cost considerations and delay this mission until after the STS-109 HST mission.
STS-109/Columbia	2nd Qtr FY 2002	2nd Qtr FY 2002	May 2001	--	Hubble Space Telescope (HST) Servicing Mission

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
STS-110/Atlantis	2nd Qtr FY 2002	2ndt Qtr FY 2002	June 2001	--	Space Station #13 (ITS-S0) (ISS-13-8A)
STS-111/Endeavour	3rd Qtr FY 2002	2nd Qtr FY 2002	August 2001	1 Qtr later	Space Station #14 (MPLM) (ISS-14-UF2)
STS-112/Atlantis	4th Qtr FY 2002	3rd Qtr FY 2002	3rd Qtr FY 2002	1 Qtr later	Space Station #15 (ITS-S1) (ISS-15-9A)
STS-113/Endeavour	4th Qtr FY 2002	4th Qtr FY 2002	4th Qtr FY 2002	--	Space Station #16 (ITS-P1) (ISS-16-11A)
STS-114/Atlantis	2nd Qtr FY 2003				Space Station #17 (MPLM) (ISS-17-ULF-1)
STS-115/Endeavour	3rd Qtr FY 2003				Space Station #18 (ITS-P3/P4) (ISS-18-12A)
STS-116/Atlantis	3rd Qtr FY 2003				Space Station #19 (Spacehab Single Module/ICC) (ISS-19-12A.1)
STS-117/Endeavour	4th Qtr FY 2003				Space Station #20 (ITS-S3/S4) (ISS-20-13A)
Number of FY 2001 Shuttle Flights	7	7	9	--	
Number of FY 2001 Days on Orbit	87	81	102	+ 6 days	Several missions were extended an extra day or two due to mission workload.
Number of FY 2001 Primary Payloads	7	7	11	--	
Number of FY 2002 Shuttle Flights	7	7	7		

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Number of FY 2002 Days on Orbit	82	77	77	+5 days	Mission workload required additional days on orbit.
Number of FY 2002 Primary Payloads	7	7	7	--	
Number of FY 2003 Shuttle Flights	4				
Number of FY 2003 Days on Orbit	40+				Only STS-114 has officially been baselined for 11-day mission duration. All other flights are ISS flights and mission duration is assumed for at least 10 days.
Number of FY 2003 Primary Payloads	5				

Lead Center:	**Other Centers:**	**Interdependencies:**
Johnson Space Center	Kennedy Space Center	Goddard Space Flight Center (HST flight) Marshall Space Flight Center (STS-107 flight)
Major Contractors United Space Alliance		Dryden Flight Research Center (alternate landing site)

PROGRAM STATUS/NOTIFICATION/PLANS THROUGH 2002

In FY 2001, seven flights were flown, all of which were ISS assembly and servicing missions. In FY 2001, 46 U.S. and international crewmembers spent approximately 540 days on-orbit, including time spent while docked the International Space Station. In FY 2002, five ISS flights are planned along with one for the third Hubble Space Telescope servicing mission, and a dedicated microgravity research mission.

PROGRAM PLANS FOR FY 2003

In FY 2003, four ISS flights are planned (ISS-17-ULF-1, ISS-18-12A, ISS-19-12a.1, and ISS-20-13A).

BASIS OF FY 2003 FUNDING REQUIREMENT

PROGRAM INTEGRATION

	FY 2001	FY 2002	FY 2003
		(Millions of Dollars)	
Shuttle Integration	148.3	180.2	252.3
Program Management Support	115.3	162.6	150.4
Facilities Construction	15.6	39.5	90.4
Program Integration Upgrades (Safety Allocation)	14.4	13.5	14.7
Total	293.6	395.8	507.8

DESCRIPTION/JUSTIFICATION

The goal of Program Integration is to ensure the integration of the various Shuttle elements occurs successfully. Program Integration performs hundreds of modifications throughout the year related to design changes to improve reliability, supportability, or meet new program requirements. These changes are a result of hardware failures or design enhancements identified through ground checkouts or in-flight. Safety investments made to the shuttle infrastructure to ensure the continued safe operations of the Space Shuttle are funded by Program Integration Upgrades.

The Program Integration budget includes funds for the analysis, management, and the SRM&QA function and is performed here for the entire Space Shuttle Program. In addition, this area includes funds for the infrastructure, taxes and directly funded construction of facilities projects.

Program integration includes those elements managed by the Space Shuttle Program Office at the Johnson Space Center (JSC) and conducted primarily by United Space Alliance, including payload integration into the Space Shuttle and systems integration of the flight hardware elements through all phases of flight.

Shuttle integration provides for the engineering analysis needed to ensure that various payloads can be assembled and integrated to form a viable and safe cargo for each Space Shuttle mission. Shuttle integration includes the necessary mechanical, aerodynamic and avionics engineering tasks to ensure that the launch vehicle can be safely launched, fly a safe ascent trajectory, achieve planned performance and descend to a safe landing. In addition, funding is provided for multi-program support at JSC.

Program management support is institutional and technical support provided by the centers in support of the program operations. The support covers a variety of activities ranging from electricity and roads to routine administrative support for the civil servants working on the Space Shuttle program.

Program Integration upgrades are funded from the Safety Allocation. Potential projects are under review as part of the safety investment prioritization process, and could include improvements and other safety-related infrastructure investments.

Construction of Facilities (CoF) funding for Space Shuttle projects is provided in this budget to refurbish, modify, reclaim, replace and restore facilities at Office of Space Flight Centers to improve performance, address environmental concerns of the older facilities and to ensure their readiness to support Shuttle Operations.

LINKAGES TO STRATEGIC AND PERFORMANCE PLANS

Strategic Plan Goal Supported: Enable humans to live and work permanently in space.

Strategic Plan Objectives Supported: Provide and make use of safe, affordable, and improved access to space.

Performance Plan Metrics Supported: 3H08: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for ISS assembly and operations.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Complete Phase IV of Rehabilitation of 480V Electrical Distribution System at MAF	3rd Qtr FY 2001	2nd Qtr FY 2001	2nd Qtr FY 2001	1 Qtr later	Phase IV, Substations Nos., 7B, 4 & 5 – core system, transformers and switchgear, breakers and oil switches. Project Completed.
Complete Restoration of Pad A PCR Wall and Ceiling Integrity at Launch Complex (LC)-39	1st Qtr FY 2000	1st Qtr FY 2001	1st Qtr FY 2001	1 year early	This project provides for repair and replacement of damaged Payload Change Out Room (PCR) wall panels (Sides 1, 2, 3, & 4), replacement or elimination of deteriorated and leaking access doors, and other needed replacement and restoration. The modification will eliminate degrading flexducts and filter housings, improve pressurization of the PCR, provide an even distribution of airflow, and provide safe personnel access for maintenance and repair. Project Completed.
Complete Convoy Operations refurbishment	2nd Qtr FY 2002	2nd Qtr FY 2001	2nd Qtr FY 2001	1 year later	This project will refurbish the SLF Convoy Operations capability at the SLF.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Complete VAB and Crawlerway Modification, LC-39 (Safe Haven)	3rd Qtr FY 2000	3rd Qtr FY 2001	4th Qtr FY 1999	1 year early	This project restores the crawlerway into VAB highbay 2 and provides an Orbiter towway into Highbay 4. This will allow use of the VAB highbays as a Safehaven during hurricanes, allow for additional manifest flexibility for stacking operations and Orbiter access operations to continue when Highbay 1 and 3 contain full stacks. Project completed.
Complete Repair VAB Elevator Controls	3rd Qtr FY 2002	1st Qtr FY 2002	2nd Qtr FY 2000	2 Qtrs later	This Project replaces the elevator systems in the Vehicle Assembly Building. The controls, cabs and cableway systems are obsolete and parts are no longer available. A recent fire in one of the VAB elevator controls caused a concern with the safety of the systems. This was identified as a safety project.
Complete Phase I Rehabilitation of A Test Stand at SSC for SSME Testing	2nd Qtr FY 2001	2nd Qtr FY 2001	2nd Qtr FY 2001	--	Phase I includes replacing structural member, rehabilitating rolling platforms level 4&5, and repair of electrical panels. Project completed.
Complete Phase II Rehabilitation of A Test Stand at SSC for SSME Testing	3rd Qtr FY 2002	3rd Qtr FY 2001	3rd Qtr FY 2001	1 year later	Phase II includes asbestos abatement, rehabilitating run tank insulation, rehabilitating shop air system, and replacement of 480 volt switchgear. Delay due to testing schedules.
Start Phase II Restoration of Pad A Low Voltage Power System	2nd Qtr FY 2002	2nd Qtr FY 2002	2nd Qtr FY 2002	--	Pad A Phase II includes redesign and refurbish and repair of USS 898 (PTCR Room 103), USS 930A and B (FSS and RSS) and remove/replace first level 480V panel boards, automatic transfer switches, and feeder circuits .
Start Phase II Restoration of Pad B Low Voltage Power System	2nd Qtr FY 2002	2nd Qtr FY 2002	2nd Qtr FY 2002	--	Pad B Phase II includes redesign and replace substation 1052 (PTCR) power systems and remove/replace first level 480V panel boards, and automatic transfer switches and feeder circuits.

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
Completion of Repair and Upgrade of Substations 20A/20B	2nd Qtr FY 2002	2nd Qtr FY 2002	2nd Qtr FY 2002	--	This project replaces switchgear and 480V distribution system, feeders, MCC, panels, bus duct, and switches in Bldg. 110, VAB, at MAF.
Start Refurbish Air Pressurization System Pads A&B	4th Qtr FY 2001	4th Qtr FY 2001	4th Qtr FY 2001	--	This project repairs/replaces the pressurization tunnels from the Remote Air Intake Facility to the Pad Terminal Connection Room (PTCR) emergency vehicle park area. Provide drainage and lighting for the tunnels, replace pressurization fans, wiring, replace motors and dampers, air intake louvers, filters, racks, seal doors, remove asbestos. Project started on schedule.
Start Repair of the VAB Lowbay Elevator	3rd Qtr FY 2001	3rd Qtr FY 2001	3rd Qtr FY 2001	--	This project refurbishes four VAB lowbay elevators and the roof elevator. Includes replacing the motor-generator set to eliminate commutator, brush and bearing maintenance, replace relay panels. Project started on schedule.
Start Repair of Pad B Flame Deflector and Trench	2nd Qtr FY 2004	4th Qtr FY 2002	4th Qtr FY 2002	6 Qtrs later	This project provides for repair of the fire resistant surface of the Main and SRB flame deflector, repair/replacement of damaged and corroded structural members, and repair/replacement of bricks in the Flame Trench wall. Project scheduled to start 2nd Qtr FY 2004; no open work window available until then.
Start Replacement of Chilled Water/ Steam/Cond. System (FY 02) Phase I	2nd Qtr FY 2002	2nd Qtr FY 2002	2nd Qtr FY 2002	--	This project replaces critical chilled water/steam/condensate systems in Building 110 and 114 at Michoud Assembly Facility . Route piping from mechanical equipment room and tank farm to north side of the VAB and to building 103 central plant mains. Replace chilled water pumps, condensate receiver stations, shutoff valves, circuit setters, strainers, control valves, etc.
Start Refurbish RSS Drive Trucks	4th Qtr FY 2002	2nd Qtr FY 2002	2nd Qtr FY 2002	2 Qtrs later	This project repairs or replaces the RSS Drive Trucks on each Pad. The trucks are used to retract the RSS to park position at about 18 hours before launch. Each of the two trucks consist of two right hand and two left hand bogies of two wheels each that are electric motor driven through gear box and drive train

Milestones	Plan in FY 2003 Budget	Plan in FY 2002 Budget	Plan in FY 2001 Budget	FY 2002-FY 2003 Change	Comment
PAD A/B Low Voltage Power Restoration, Phase 3	2nd Qtr FY 2003				This project removes/replaces first level 480V panel boards, and automatic transfer switches and feeder circuits.
Upgrade LC-39 Area Power Distribution System, Phase 2	2nd Qtr FY 2003				This project replaces all power feeder cabling throughout the LC-39 Area. This project is mandatory to ensure reliability of the power distribution system to support shuttle flight operations.
Replace Chill. Water/Steam/Cond. Sys. Phase 2	2nd Qtr FY 2003				This project provides for the reconfiguration of the chilled water, condensate and seam systems to meet current requirements.
Replace Paint Spray Facility – where?	2nd Qtr FY 2003				This project will replace obsolete Paint Spray Facility and associated components with an efficient state-of-the-art unit.
Replace Cell E AHU's Nos. 1 & 2 (110)	2nd Qtr FY 2003				Replace production critical ET air handling units 1 and 2 supporting Cell E internal and external tank drying systems.
Rehabilitate A-2 Test Stand for SSME Testing	2nd Qtr FY 2002				This project provides repairs to basic infrastructure of the A-2 Test Stand.
Finish Repair of the VAB Lowbay Elevator	4th Qtr FY 2003				This project refurbishes four VAB lowbay elevators and the roof elevator. Includes replacing the motor-generator set to eliminate commutator, brush and bearing maintenance, replace relay panels.
Finish Refurbish Air Pressurization System Pads A&B	4th Qtr FY 2003				This project repairs/replaces the pressurization tunnels from the Remote Air Intake Facility to the Pad Terminal Connection Room (PTCR) emergency vehicle park area. Provide drainage and lighting for the tunnels, replace pressurization fans, wiring, replace motors and dampers, air intake louvers, filters, racks, seal doors, remove asbestos.

Lead Center:	**Other Centers:**
Johnson Space Center	Kennedy Space Center
	Marshall Space Flight Center
	Dryden Flight Research Center
	White Sands Test Facility
Major Contractors	
United Space Alliance	

PROGRAM STATUS/NOTIFICATION/PLANS THROUGH 2002

The Shuttle program provides cargo integration and systems integration, which is required for each flight planned in FY 2002 and FY 2003. Cargo integration includes tasks to ensure cargo safety and to develop orbiter cargo interface requirements for each flight. The system integration effort encompasses System Safety and Hazard reviews, integrated avionics, and vehicle/ground integration that are required for each flight as well. In FY 2002, seven flights are planned - ISS will require five missions, a Hubble Space Telescope servicing mission will be performed and a dedicated microgravity research mission will be flown. In FY 2003, the Shuttle is planning

Assessment of potential infrastructure investments as part of the Safety Allocation will continue in FY 2002. Pending investment decisions, potential projects could begin in FY 2002 or FY 2003.

FY 2001 CoF funding will provide for improvements for facilities at JSC, KSC, MAF and SSC. At KSC there are 3 projects that complete the refurbishment of Pad B Payload Change Room (Wall and Ceiling), phase 1 of restoring low volt power system (Pad A and B), and the rehabilitation of high-pressure distribution piping system (LC-39A/B). The JSC project repairs the roofs at Palmdale, Building 150. The SSC project modifies the A-2 Test Stand for Shuttle Testing. The MAF project repairs and upgrades the main electrical distribution system servicing the Vertical Assembly Building (110) and the Mix Room Building (130).

FY 2002 CoF funding will provide for the second Phase of the Pad A & B Low Voltage Power system refurbishment, Restoration of the Pad B Flame Deflector and Trench, Restoration of the Pad A&B RSS Drive Trucks, Third Phase of the Stennis A-2 Stand refurbishment, First phase of the Chilled Water/Steam/Condensator System refurbishment at MAF, and high priority repair work on the VAB, including roof and siding repairs.

PROGRAM PLANS FOR FY 2003

FY 2003 CoF funding will provide for the third Phase of Pad A & B Low Voltage Power system refurbishment, first Phase of LC-39 Area Power Distribution System, second phase of the Chilled Water/Steam/Condensator System refurbishment at MAF, Replace Cell E AHU's Nos. 1 & e, and the Fourth Phase of the Stennis A-2 Test Stand for Shuttle Testing.

The FY 2003 budget includes $76.4M for Space Shuttle program infrastructure revitalization projects that are urgently needed to revitalize and repair critical facilities, systems and equipment that support the Space Shuttle program. The majority of these projects are located at Kennedy Space Center, but a number of projects are also required at Johnson Space Center, Marshall Space flight Center, the Michoud Assembly Facility, White Sands Test Facility, and the Stennis Space Center. The budget runout for the Space Shuttle infrastructure revitalization projects is $370.6 million through FY 2007. A major component of this funding is the revitalization of the roof, siding, and doors of the Vehicle Assembly Building (VAB) at KSC.